DOCUMENT RESUME

ED 128 170 SE 020 913

AUTHOR	Grimes, George M.
TITLE	Handbook for Veterinary Faculty: Use of the PLATO System. CERL Report X-39.
INSTITUTION	Illinois Univ., Urbana. Computer-Based Education Lab.
SPONS AGENCY	National Science Foundation, Washington, D.C.
REPORT NO	CERL-R-X-39
PUB DATE	Jan 73
NOTE	51p.; Not available in hard copy due to marginal legibility throughout original document
AVAILABLE FROM	PLATO Publications, Computer-Based Education Research Lab, 252 Engineering Research Lab, University of Illinois, Urbana, Illinois 61801 (no price quoted)
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Computer Assisted Instruction; Computers; *Higher Education; Instruction; *Instructional Programs; Professional Education; Science Education; *Teaching Guides; Teaching Methods; *Veterinary Medicine
IDENTIFIERS	*PLATO; Programmed Logic for Automatic Teaching Operations

ABSTRACT

This document, intended for faculty at the University of Illinois College of Veterinary Medicine, provides information about the PLATO computer-based instructional system and instructions for participating in lesson preparation. The physical components of the PLATO system and the PLATO IV terminals, student consoles, and teaching stations are described. The educational characteristics and instructional methods of the PLATO system are discussed. Also discussed are the background, rationale, organization, and functions of the College of Veterinary Medicine PLATO Program. Instructions are given for developing a lesson on PLATO, including probable time required. (MH)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED128170

CERL Report X-39 January, 1973

16

HANDBOOK

for veterinary faculty use of the PLATO system

GEORGE GRIMES

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: SE IR
In our judgement, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY
CERL
TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

at the
College of Veterinary Medicine
University of Illinois

SE 020 913

FOREWORD

PLATO is a unique resource available only on the U-C campus of the University of Illinois. The utilization of PLATO to foster individualized learning by veterinary students and to assist the instructional faculty, is a unique and stimulating challenge facing the faculty of the College of Veterinary Medicine at Illinois.

PLATO is not a complete teacher; in fact, PLATO is only one of several kinds of teaching aids that probably should be available in a complete learning and teaching situation, viz., audiovisual tapes, televisions, projection slides, line illustrations, teaching models and printed materials including books. Many students and teachers will adapt enthusiastically to PLATO whereas a few may not; so be it. In general, that method which is individually most effective for learning is the best, no matter what its nature. However, it is doubtless prophetic that John G. Kremeny, President of Dartmouth College, states in his new book, Man and the Computer, that he expects 90% of the future graduates of Dartmouth to be capable and accustomed to utilizing the computer as an all-pervasive tool for academic learning and societal convenience in the next generation.

It appears to me that members of the faculty and student body of this college would be amiss not to inform themselves regarding the Veterinary PLATO Program in all of its potential for learning and instruction in the veterinary curriculum. It is quite clear that the State of Illinois can not finance the education of all its citizens wanting to study veterinary medicine; neither can this college supply enough graduates within the limitations of its present or projected physical facilities to meet the public demand for veterinary service. Somehow more effective methods of educating veterinarians at a lesser cost in time and dollars must be found than now exists in the present pedagogical system. Perhaps the Veterinary PLATO Program offers a significant potential to the veterinary faculty for meeting this challenge, as a means for the faculty to improve the quality of teaching, as well as to meet its pedagogical responsibilities to the University, the veterinary profession and the public.

The administration of the college and of the University of Illinois have given strong moral and financial support to PLATO, as a system having a tremendous significance in the future of higher education in general and for the health professions in particular. On the national scene, the National Science Foundation, joined recently by the National Institutes of Health, have extended financial support for educational research in the applied uses of PLATO.

I commend the Veterinary PLATO Project to the faculty and students of the College of Veterinary Medicine and hope that all will give serious consideration to its merits.

L. Meyer Jones, Dean
College of Veterinary Medicine

TABLE OF CONTENTS

	PAGE
Purpose	1
Philosophy	2
The University of Illinois PLATO System	4
Definition	4
History	4
Physical Components of PLATO System (Hardware)	7
PLATO IV Terminals (Student Consoles, Teaching Stations)	9
Programming a Lesson on PLATO	12
Student Use of a Lesson	15
Educational Characteristics and Instructional Methods	17
Educational Characteristics	17
Instructional Methods	21
College of Veterinary Medicine PLATO Program	30
Background	30
Rationale	31
Organization and Functions	34
Time Required to Produce a PLATO Program	38
Developing a CVM Lesson on PLATO	38
Developing a case for the "Veterinary Diagnosis Program"	45
Credit and Author Protection	45

PURPOSE

The purpose of this handbook is to provide the faculty of the College of Veterinary Medicine with information about the PLATO system and to provide instructions for participating in lesson preparation. It is not intended that faculty members necessarily program their own lessons; however, it is hoped that this handbook will aid the teacher in seeing more clearly the role of PLATO in the repertory of educational tools.

George M. Grames

George M. Grames, D.V.M., M.M.S. (Biomed, Comm.)
Coordinator, PLATO Project, CVM

Cover and drawings by Lucy V. Vokac.

PHILOSOPHY

The PLATO program of the CVM is intended to be a service oriented operation for the faculty and students of the college. It is intended to support their endeavor to improve the quality of veterinary education by using computer-based instruction and training where appropriate.

The PLATO program should be beneficial to the faculty. It should reduce the amount of impersonal instruction to large groups and increase the amount of personal individual instruction. It should reduce the amount of repetitious instruction and free the instructor for more creative communication with his students. It should reduce the amount of "paper-grading" and mathematical manipulation of grades, and increase his knowledge of the student's proficiency by means of better records and statistical analysis of those records. It should increase the instructor's prestige as he uses advanced methods to communicate with his students. Furthermore, his prestige should be further increased as PLATO spreads beyond the university and State of Illinois. Programs that are acceptable by an instructor's colleagues, or prepared in cooperation with them, may be used at other veterinary schools in the future. There is also the possibility of increased income. CERL has requested that a royalty be paid to those who have a substantive input into the preparation of programs on PLATO.

The PLATO program should be beneficial to the students. It should insure, by individualization and extensive interaction, mastery of lessons that are programmed. The student should be able to use his time more efficiently by working at his own pace, by branching over material he

already knows, and by time-compression of some of the laboratory exercises. The program should reduce erroneous learning by providing immediate feedback to the student. It should provide more realistic learning through display of color visuals, graphics, playing of audio-recordings, problem solving exercises, simulations and gaming.

HANDBOOK FOR VETERINARY FACULTY
USE OF THE PLATO SYSTEM

George M. Grimes, D.V.M., M.M.S.
Coordinator, PLATO Project
College of Veterinary Medicine
University of Illinois, Urbana, Illinois

PART I

THE UNIVERSITY OF ILLINOIS PLATO SYSTEM

Definition:

The PLATO system is a computer-based system totally devoted to education. The word "PLATO" is an acronym for Programmed Logic for Automatic Teaching Operations; however, this phrase does not adequately identify nor describe the system.

History:

Although the PLATO system is a new dimension in computer-based education, it is based on research and development. Since 1959, it has passed through four stages.

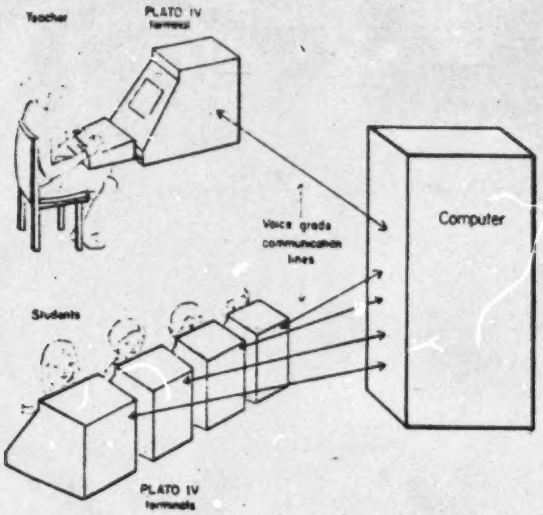
PLATO I consisted of one terminal and PLATO II of two terminals. PLATO III consisted of 75 terminals, any 20 of which could operate at any one time. PLATO IV may consist of as many as 2000 to 4000 terminals. Twenty of the PLATO III terminals were located in a classroom at CERL (Computer-based Education Research Laboratory). Others were located at various sites on the UI campus, at a school of nursing, at a nearby elementary school, and one was located at Springfield, Ill. It was necessary that PLATO III terminals be connected to the computer center by means of expensive coaxial (television) cables. PLATO IV terminals require only

voice grade communication channels; therefore, they may be economically located hundreds of miles from the computer.

PLATO III terminals used television type display screens with black and white images. It could display alphanumeric characters, graphics, and black and white line drawing pictures. The major breakthrough in the development of the PLATO IV system was the invention of the "plasma panel" by Bitzer and Slottow in 1964. The plasma panel is a display screen on which computer-generated characters are shown. It also permits rear-view projection of color visuals on the same screen. In addition, the PLATO IV system also has a touch panel capability and a random access audio retrieval unit which can play short messages when activated by the computer.

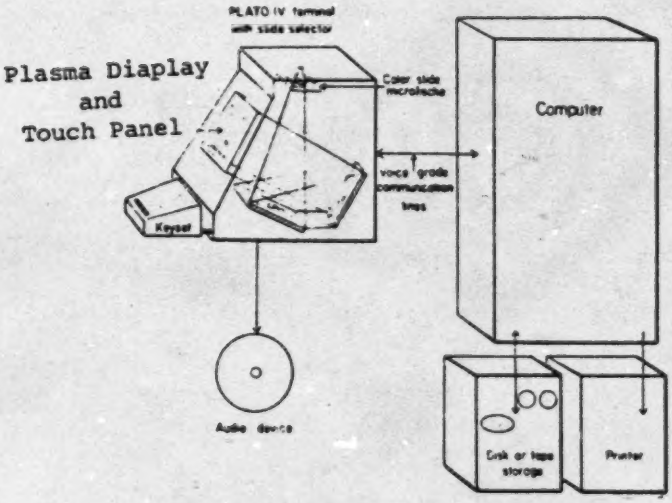
Only about 3 average size lessons could be taught on PLATO III at one time. PLATO IV permits many times that number of lessons to be taught at one time. Even with its limitations, PLATO III was used to teach more than 100,000 student-contact hours in a wide variety of subjects (languages, nursing, mathematics, biology, physics, chemistry, etc.) to a wide range of students from preschoolers to postgraduates.

PLATO IV with its large scale computer, extensive flexibility, economic feasibility, and capacity of wide distribution of terminals is expected to probe new horizons in education.



PLATO IV

Figure 1. The PLATO system has many terminals communicating with one computer.



PLATO IV

Figure 2. Diagram of PLATO system hardware.

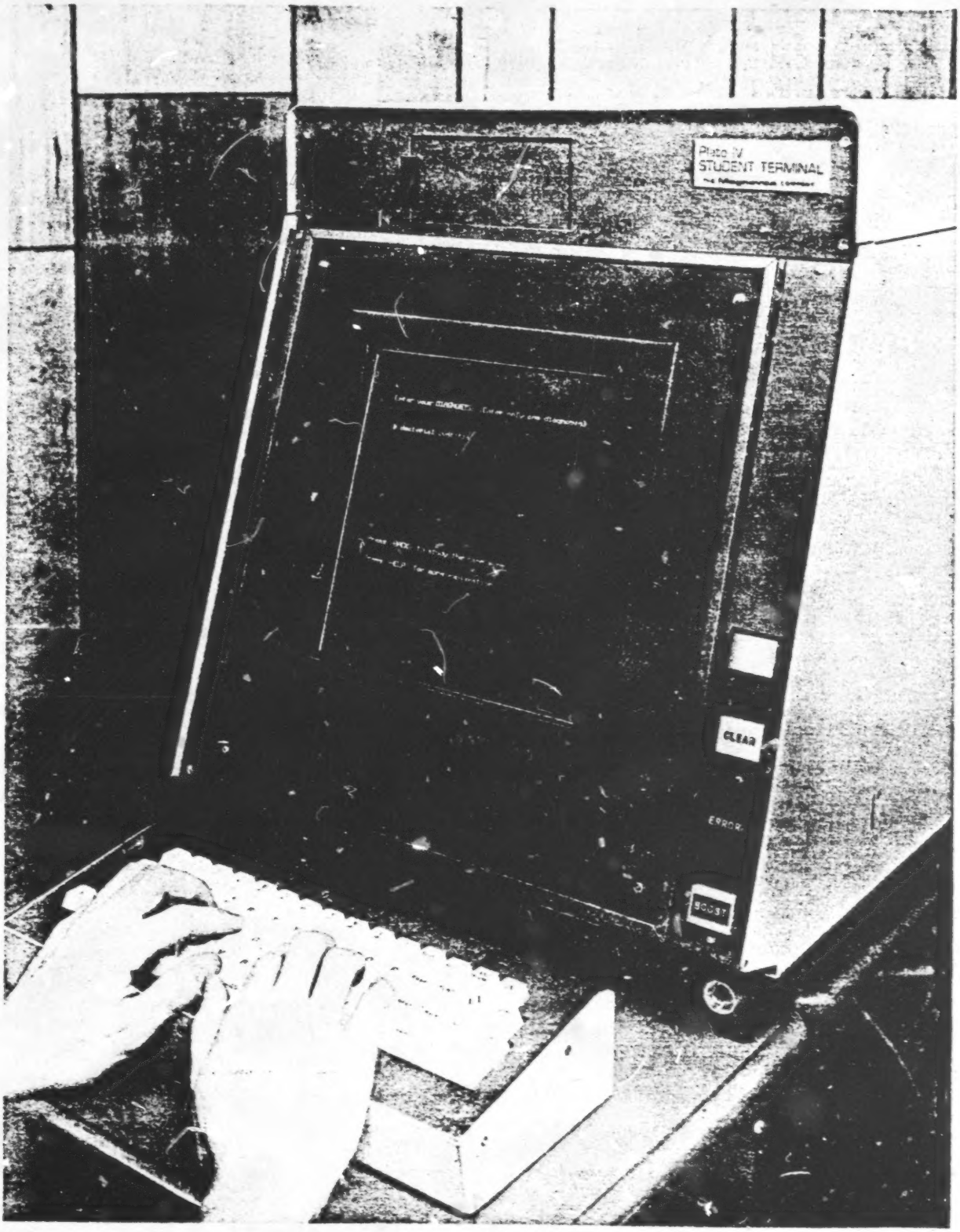
Physical Components of PLATO System (Hardware):

The PLATO system consists of a large scale computer, Control Data Corporation 6000 series computer with auxillary and interface equipment connected to numerous PLATO terminals by means of inexpensive communication channels (fig. 1). The computer is the information-processing brain of the system. The auxillary equipment permits such operations as storage of lessons on disks or tapes, and printout of programs (fig. 2). Interface equipment makes possible the use of numerous terminals on an individual basis.

The many PLATO IV terminals may be located at great distances from the computer. They have been operated on a demonstration basis from Europe, and on a regular basis from both coasts of the United States. Only "voice grade" communication channels (telephone lines, satellite transmission, etc.) are needed for communication with the computer.

Terminals located at the College of Veterinary Medicine will be connected to the computer by means of a private telephone line. The speed with which information can be transmitted over the line (milliseconds) and the relatively slow speed of students using the terminals (seconds) permits time for the interface equipment to keep track of the terminals and students. Several lessons may be used at one time, and students may work in different parts of the same lesson at any one time. For example, twenty students at the College of Veterinary Medicine may be working on four different lessons (e.g. Veterinary Diagnosis Program, Pupillary Reflex Program, Veterinary Mycology, and Identification of Hormone Unknowns). Four of these students may be working on the Veterinary Diagnosis Program, one on the first case, two on the second case, and one on the third case, all in different parts of the same lesson. At the

Figure 3. PLATO IV Terminal



same time, a programmer may be writing a lesson from another PLATO IV terminal exactly like the ones the students are using.

PLATO IV Terminals (Student Consoles, Teaching Stations):

The PLATO IV terminal (see fig. 3) consists of a keyboard, a plasma display panel, and a slide selector. A random access audio unit and a touch panel can be used as optional equipment. Students communicate with the computer by means of a keyboard or touch panel, and the computer communicates with the student by generating alphanumeric characters or graphics on the plasma display panel, by activating the slide selector showing color pictures, or by activating the audio device which plays a recording. The keyboard has the same characters as a typewriter plus several other keys functionally useful for education: NEXT, HELP, DATA, LAB, BACK, etc. The student may type letters, numbers, words, or sentences, or press one of the specialized keys to communicate with the computer. Most lessons are designed for minimum typing. However, students who are completely inept at typing soon become accustomed to the keyboard.

The plasma display screen consists of a grid of fine wires imbedded in two plates of glass separated by a space containing neon gas. Fine gold wires are deposited on the glass plates - horizontally on one plate and vertically on the other - forming a gridwork of 256,000 intersections. The computer can "write" in this display screen by turning on the appropriate wires to light neon gas at any intersection. This design permits computer generated characters and graphics to appear on the screen. The panel is also transparent, permitting rearview projection of color pictures from a microfiche. Computer generated material such as words or circles can appear

on the screen superimposed on a color picture. The microfiche contains 256 color pictures which are randomly accessed upon command of the computer in less than 1/3 of a second.

The touch panel allows a student to indicate a particular area on the display with his finger. It consists of a grid of infrared beams with 256 intersections covering the screen. When the student's finger interrupts the beams, the device detects the location and sends a message of the student touch to the computer. It is similar to the "electric eye" used for opening doors at some business establishments.

The random access audio unit plays recorded messages of sounds upon command of the computer. The information is recorded on a disk which holds approximately 22 minutes of audio material. Messages may be from 1/3 second to 1 minute in length. Upon command of the computer, the device retrieves any message from sound tracks on the disk within 1/3 second. In veterinary medicine, recorded heart sounds, respiratory sounds, or other body sounds can be made available to the student on PLATO. These are randomly accessed and played for the student according to what the clinical specialist desires the student to hear.

The capabilities of displaying computer generated material, displaying color slides, playing recorded messages, and using the keyboard and touch panel can be employed in any combination. For example, if the plasma panel displays a slide of the heart area, computer-generated circles can indicate various heart valve areas, words can ask the student to touch the heart valve area he wishes to hear, the touch panel can indicate the part the student touches, and the computer will activate the audio device which plays the heart

sound from that area. These capabilities, plus branching techniques characteristic of computer-assisted instruction, are used in a number of veterinary lessons which have been programmed on PLATO.

Programming a Lesson on PLATO:

The physical components of the PLATO system, known as "hardware," have been briefly described. The programs, nonphysical components of the system which make it perform as a computer, are known as "software." The digital computer operates at the most elementary level in base 2 (0 or 1, on or off, magnetized or not magnetized, etc.). This is sometimes known as "machine language." Since it would be impossible, under practical conditions, to program in "machine language," other "higher" languages must be interjected between the programmer and the machine. One of the "Highest" computer languages is known as "TUTOR." This language, which is much like English, is used to program PLATO. TUTOR, as the name implies, is particularly intended for education. (Other programming languages with which the reader may be familiar are COBOL, used in business programming, and FORTRAN, used in scientific programming.)

The TUTOR language is written by the "Systems Programmers" of CERL. Lesson programmers use the TUTOR language in writing their own lessons. A brief description of using this language will be given later.

The steps in programming a lesson are as follows:

1. First, a lesson space must be requested and obtained from CERL.
2. This lesson space is given a file name consisting of 10 letters or less. For example, "case," "bact," "puflex," etc.
3. When an individual is programming a lesson at a terminal, he is said to be in the "author mode". When he or a student is using a lesson, they are in "student mode". Lessons may be programmed or used from any PLATO terminal.

4. Basically, a lesson is divided into "units." A unit may be compared with pages in a "scrambled-page" programmed book, or frames in a written programmed instruction text. The information the student sees on the screen is usually only one unit. However, another unit may be "joined" to put additional information on the same screen.

5. Units contain TUTOR "statements" which each consist of a "command" and a "tag." The command instructs the computer to perform a specified function, e.g. WRITE commands the computer to write on the screen the information that is to follow (in the tag). The tag contains the information the computer has been "commanded" to perform. For example:

Command	Tag
write	What is the common name for a canine?

The words "What is the common name for a canine?" are the words the student will see on the screen.

Commands are generally of two types, regular and judging.

a. "Regular" commands are rather straightforward such as "WRITE," "At," "Slide," etc.

b. "Judging" commands judge the student's answer such as "Answer," "Wrong," "Concept," etc.

6. Listed below is an example of how a unit may look in the program of a lesson.

```
unit      DOG
at        1012                          (line 10, space 12)*
write     What is the common name for a canine?
arrow     1415                          (Place an arrow at line 14,
                                        space 15 and start judging
                                        the student's answer.)
answer    Dog                           (a correct answer, judge OK)
at        1515                          (line 15, space 15)
write     Excellent                     (the response if the answer
                                        is dog)
wrong     Cat                           (a wrong answer, judge NO)
at        1515                          (line 15, space 15)**
write     You should know better        (the response if the answer
          than that.                    is cat)
```

*NOTE: The screen consists of 32 lines and 64 spaces.

**NOTE: Although the "Wrong" answer comment is written at the same location as the correct answer comment (1515), this creates no problem since only one answer will occur at a time.

The regular commands in the example given above are: unit, at, and write.

The Judging commands are: answer, and wrong.

There are more than 100 commands in the TUTOR language. By manipulating these commands, highly sophisticated programs can be written. The above example is an extremely simple example to indicate how programming a lesson may occur.

During the programming of a lesson and after it is written it is reviewed and revised numerous times until it performs specifically as intended. Unlike a book, a PLATO program should never be said to be complete or finished. Months after a program is in use, it may be altered by its author as a result of findings by students.

Lessons may be "printed out" for study remote from the terminal.

Student Use of a Lesson:

Lessons (programs) are stored on disks or tapes. When ready for use by a student, the lesson is transferred to the "core" of the computer. Many other lessons may be in core at the same time, but the computer keeps track of which lesson is in use at which terminal. There is a limit to the number of lessons, according to their lengths, which can be in core at one time. If there is not enough room in core when a lesson is read in, a notice will appear on the screen, "No room in ecs" (ecs=extended core storage).

In a separate program, student names and the lessons they are permitted to study are recorded. Student names that are not recorded are not permitted to use the lesson without the permission of the instructor. While the student is interacting with the lesson, this program keeps a record of his progress. Later this record provides the following information:

1. It indicates where the student stops. When the student re-enters the program at a later time or date, he will start where he left off.
2. It informs the instructor of the progress of the student. From the record the instructor may have private discussions with the student to help the student better understand the subject-matter.
3. The record may be used for statistical evaluation of the student's performance in the program.

With the lesson read into the core of the computer and student records set up, the student is then permitted to study the lesson. He interacts

with the lesson as designed by the program. It may be a simple test, a problem solving situation, a simulation of a real world activity, or a drill and practice at some skill in which he needs to become proficient.

As indicated earlier, upon completion of the period, the student may sign out of the lesson and return to complete it at another time. When he completes the lesson, the message "End of Lesson" appears on the screen.

PART II

EDUCATIONAL CHARACTERISTICS AND INSTRUCTIONAL METHODS

Educational Characteristics of PLATO:

The PLATO system has characteristics which make it particularly suitable for educational purposes:

a. INDIVIDUALIZATION - A student works as an individual at the PLATO terminal. He may work on lessons different from other students, or he may work in different locations in the same lesson, and still be recognized by the computer on an individual basis. Some of the characteristics to follow may be considered aspects of individualization.

b. ACTIVE PARTICIPATION - The student and the computer interact with one another in an active learning experience for the student. The student or the computer may ask or answer questions according to the program.

c. SELF-PACING - The student may work as fast or as slow as his ability and desires permit. He is limited only by the amount of time he is permitted to use the system.

d. FEED-BACK FOR THE STUDENT - The student receives immediate knowledge of results of his answers to questions or solution to problems.

e. FEED-BACK FOR THE INSTRUCTOR - The instructor can receive information on the progress of the student from records compiled by the system.

f. PERSONALIZATION - By using students names and response history in programs and by providing a large number of responses to student questions, the system can become rather personal to individual students.

g. TIME-COMPRESSION - Some programs reduce the amount of time necessary for the student to receive an answer to his inquiry. For example, in the bacteriology and the mycology programs, the amount of time necessary for the student to see how an organism appears when it grows on certain media is reduced from hours or days into seconds.

h. RAPID EDITING - When "feed-back" indicates changes should be made in the program, the PLATO system permits rapid editing of the program from the same terminals used by the students. Revision of an answer, misspelled words, or grammatical errors can be corrected in as little as 30 seconds. Revisions in teaching strategies may require a number of hours for reprogramming.

i. RECOGNITION OF ALPHANUMERIC CHARACTERS, WORDS, SENTENCES, OR CONCEPTS - The recognition of single letters or numbers is common in other computer-based systems, but longer strings of characters are limited. The PLATO system not only recognizes words and sentences entered by the student, but by use of synonyms, a concept written in several different ways may be recognized. For example, in the "Veterinary Diagnosis Program," if "basic complaint" is the concept, the student will receive the same answer to: "What is the problem?" "What's wrong?" "What is the incoming complaint?" "What is the animal's trouble?" "What

is wrong with the animal?" etc.

j. RANDOM ACCESS DISPLAY OF COLOR VISUALS - Color transparencies from a microfiche can be displayed on the plasma panel by rear-view projection as established by the program. For example, a student working in the bacteriology program may request a gram stain on his unknown organism. A color picture of the organism under gram stain is then shown on the screen. In this particular lesson, while the picture is still on the screen, the student is requested to interpret the findings.

k. RANDOM ACCESS PLAYING OF AUDIO RECORDINGS - From a prerecorded disk, an audio recording may be played as established by the program. For example, in a program "Normal and Abnormal Heart Sounds," a heart sound may be played for the student who must identify the sound (e.g. patent ductus arteriosus, split-first sound).

l. BRANCHING WITHIN OR BETWEEN LESSONS - As previously indicated, the basic components of a lesson are units. Either as established by the program, or by the action of the student, the student may be sent to, or select another unit anywhere in the lesson. For example, if a student is in a unit which asks a question, the student enters an answer. If his answer is correct, he may go to the next unit for another question, or he may skip several units to a more advanced question. If he gets the answer wrong, he may be sent to an entirely different unit that tells him he is wrong and gives him corrective information. Before the student answers the question, he may press the key -HELP-

and be branched to a "help" unit which gives him additional information on the question.

Branching between lessons is also possible on the PLATO system. If a student is working in the "Veterinary Diagnosis Program" and needs to go to the "Veterinary Mycology" program to identify a fungus, then return to the case, this branching can be programmed into the lesson.

m. GRAPHIC CAPABILITY - Still or moving graphics may be displayed on the screen. A graphic display of a dog or the optic tracts may be displayed. Moving nerve impulses along the optic tract may be represented by lengthening dotted lines moving from the eye to the brain. A moving graph on a scale may be displayed which indicates the blood glucose level as it is affected by an injection of insulin.

n. STUDENT CHOICE - The PLATO system permits the instructor to give the student the opportunity to choose lessons or materials to be studied, if he desires. For example, in the program "Formulation of a Radiographic Technique Chart," the student is permitted to select the size of x-ray unit he wishes to use to make his technique chart. This allows the student to express his own desires, or select the machine he expects he will be using upon graduation.

Many of the characteristics described above are inherent in individualization and are used in each lesson developed for the College of Veterinary Medicine. All lessons provide: individualization, active participation, self-pacing, feed-back, rapid editing, recognition of alphanumeric characters, and branching within lessons.

Instructional Methods:

The flexibility of the PLATO system permits numerous teaching methods to be used. These may vary from a simple linear testing to a complex gaming simulation of a "real world" situation. Most PLATO lessons use a combination of methods in each program. Instructional methods possible on PLATO may be based on:

1. Routing through the program, 2. The amount of repetition, 3. The modes of student interaction with the computer, 4. The amount of display, and 5. Type of problem solving.

1. Routing through the program is the basis of two methods which may be used: "linear" and "branching." In many programs, some of both are used. With linear routing, the student proceeds in a "straight-line" manner from one point to the next without opportunity to branch to other parts of the lesson. A typical example of linear routing is a quiz in which the student receives no help, nor opportunity to change course. PLATO helps by keeping a record of the student's answers. This record can be used to indicate to the student his weaknesses in the subject matter, or to the instructor the proficiency of the student in the subject matter. Branching has been described earlier in this document. It is the most frequently used type of routing as the student receives help, cues, feedback, etc. or as he indicates that he wishes to proceed to another part of the lesson by pressing -BACK-, -DATA-, -HELP-, etc.

2. The amount of repetition determines the amount of "drill and practice" to be afforded by the program. The student may be patiently drilled in a lesson by PLATO. For example, in the program "Identification of Normal and Abnormal Heart Sounds," the student may repeat the audio

heart sounds over and over until he is able to recognize them. Some lessons provide practice in application of principles while varying the content of the lesson. For example, in the "Veterinary Diagnosis Program," the student receives practice in diagnostic procedures as he diagnoses a number of different cases. Drill and practice may also be accomplished by repeating lessons, which the students frequently do.

3. The modes of student interaction with the computer indicates three methods which may be used: "Tutorial," "Inquiry," and "Dialog." These depend on whether the computer or the student assumes the initiative for guiding the learning of the student, or whether there seems to be a dialog between the two. Dialog or Socratic or discussion may be considered a combination of both tutorial and inquiry.

a. The computer initiates the inquiry:

(1) The computer may present the inquiry in several, or a combination of several ways:

(a) A written question (e.g. What is this heart sound?)

(b) A picture with a question (e.g. Picture of a cell with question: Identify the golgi apparatus.)

(c) A graphic with a question (e.g. Graph of blood glucose level with question: Use the arrows to indicate the change of blood glucose level after the injection of epinephrine.)

(d) An audio recording with question (e.g. Sound of abnormal heart condition with question: What is a disease this heart sound is associated with?)

(2) The student may respond to the computer inquiry in several ways:

(a) By typing a single alphanumeric character (e.g. a, b, c, or 1, 2, 3, etc.)

(b) By typing a number of letters, words, or numbers (e.g. It is a patent ductus)

(c) By typing various characters on the keyboard (e.g. +, -, ↑, ↗, ←, or ↘)

(d) By filling in a chart (e.g. radiographic technique chart formulation)

(e) By drawing on the screen using dots, dashes, arrows, etc. (e.g. Using arrows, draw a bell-shaped curve.)

(f) By touching a location using the touch panel (e.g. Touch the heart valve area.)

(g) By drawing a line using the touch panel (e.g. With a picture of the abdomen of a dog on the screen, draw a line with your finger where you wish to make the incision.)

(h) By asking a question ("dialog") (e.g. Computer: "What do you wish?" Student: "What is the temperature?" Computer: "102.5°F.")

(3) The computer may respond to the student's answer in one or a combination of ways:

(a) OK or NO (e.g. Student answer is right or wrong.)

(b) With a constructed answer (e.g. "You are doing great!" or "Another answer is better."

(c) No answer until later. (e.g. In one program, no answer is given until both diagnosis and treatment are evaluated.)

(d) The correct answer (e.g. After several tries, the student may be given the correct answer.)

(e) Help, cue, or guidance in finding the correct answer (e.g. After the student has given the wrong name to a heart valve area, the computer may respond: "This is not the aortic valve. Press -HELP- for the names and descriptions of all the valve areas.)

(f) With a picture (e.g. After the student has answered several questions correctly, the computer may show a picture indicating how all the parts fit together.)

(g) With an audio-recording (e.g. If a student has indicated that an abnormal heart sound is normal, the computer may play the normal for him in order for the student to hear the difference.)

(h) By a graphic design such as a circle, arrow, or graph (e.g. If a proper area in a picture is not selected, the computer may respond with a circle or arrow to indicate the correct area.)

(i) With a computer-generated question (e.g. To a question concerning diagnosis, the student may answer "cystitis." The computer may respond, "What kind of cystitis?") ("dialog")

b. The student assumes the initiative in making the inquiry (or asking questions):

(1) The student may present his questions in several ways:

(a) By pressing a single alphanumeric character where a list of questions are presented. (e.g. The student presses a number or letter of the inquiry he wishes to select.) Ordinarily this is not considered an effective method of asking a question; however, it may be very effective where a record is kept of the inquiries the student selects and is judged on his ability to select the proper questions.

(b) By typing a question (e.g. How long has the dog been sick?)

(c) By touching the display screen (e.g. The student may point to a place on a picture of a cell which he desires to see enlarged.)

(2) The computer may respond to the student's question in one or a combination of ways:

(a) With a constructed answer (e.g. She has been sick for two weeks.)

(b) With a picture (e.g. An enlargment of a part of a cell.)

(c) With a graphic display (e.g. A phonocardiogram of a heart sound.)

(d) An audio recording (e.g. A recording of the lung sounds by stethoscope when requested by the student.)

(e) A question back to the student (e.g. The student may ask the question: "How long?" and the computer respond: "Please be more specific" to which the student responds: "How long has she had blood in the urine?" which the computer answers: "About two months.") ("dialog")

(3) The student may respond to the computer's answer in several ways:

(a) He may collect information to make a decision (e.g. In the "Veterinary Diagnosis Program" the student collects information on the cases to make a diagnosis and give proper treatment.)

(b) He may disregard the answer as being of no value.

(c) He may ask another question

(d) He may provide the answer to the question the computer has asked. (See b. (2) (e) above)

(e) The student may use one of the specialized keys to branch to another part of the lesson. (e.g. The answer may remind him to look at the patient's records. By pressing the key -BACK- the records are provided.)

4. A large amount of display with minimal student interaction may indicate that the instructional method is a "Demonstration." The graphing capabilities of PLATO permits the demonstration of sensory and motor pathways of nerve impulses. Graphing or a series of pictures may animate

phagocytosis. Pictures and audio recordings may demonstrate heart valve locations and sounds therefrom.

5. The type of problem solving may indicate that the strategy is "Problem Solving," "Simulation," or "Gaming."

a. "Problem Solving" implies that a problem is presented and the student seeks the solution. It is not necessarily associated with a model of a real world situation (simulation). Some examples of problem solving in veterinary programs include:

(1) Identification of parts of a cell in the program: "Cytology."

(2) Solving problems using the Nernst equation in the program: "Bioelectric Properties of the Cell Membrane."

(3) Circulation problems in the program: "Principles of Circulation."

(4) Identification of hormones based on their expected action in a laboratory animal in the program: "Identification of Hormone Unknowns."

b. "Simulation" implies problem solving which is a model of a real world situation. Some examples of simulations in veterinary programs include:

(1) A model of a bacteriological laboratory in the program; "Identification of Bacteriological Unknowns."

(2) A simulated diagnostic situation in a veterinary practice in the program; "Veterinary Diagnosis Program."

(3) A simulation of a slaughterhouse meat inspection program

in the program, "Antemortem and Postmortem Inspection of Food Animals."

(4) Simulated heart disease cases which the clinical veterinarian may encounter in the program, "Canine Cardiac Conditions."

(5) A simulated poultry disease situation in which the veterinarian diagnoses the diseases in the program, "Poultry Diseases."

(6) A simulation of neurological disorders the clinical veterinarian may encounter in the program, "Neurological Exam."

(7) A simulated situation in which the veterinarian prepares a radiographic technique chart on an x-ray machine in the program, "Formulation of a Radiographic Technique Chart."

(8) A simulated mycology laboratory in the program, "Veterinary Mycology Program."

(9) A simulated examination of an animal for optic tract lesions in the program, "The Pupillary Reflex."

c. "Gaming" implies a problem solving strategy in which rewards and competition may tend to motivate the student. The rewards may be (simulated) dollars or percentages. The competition may be with the computer or with other students. In the program "Identification of Bacteriological Unknowns," the student is charged for the media he uses. He attempts to keep the costs as low as possible. The computer keeps

a record of his expenditures, and after the student has identified the unknown, compares the student expenditure with the estimated laboratory expenditure for the same test. The student attempts to "beat" the computer. In the program "Identification of Hormone Unknowns," the student is charged a percentage each time he tests his hormone. He attempts to identify the hormone with the least number of required tests, thus with the greatest percentage of efficiency.

PART III

COLLEGE OF VETERINARY MEDICINE PLATO PROGRAM

Background:

The first two years of the CVM PLATO project were concerned with probing the various capabilities of computer-based education using the PLATO system. Now, by means of a grant from NIH and other support from CERL, the College of Veterinary Medicine is able to put into practical service that which has previously been experimental.

During the summer of 1970, the College of Veterinary Medicine began to prepare lesson material for PLATO IV. By the fall of 1972, the transition from PLATO III to PLATO IV was in progress. By that fall, some 25 lessons, involving approximately 22 faculty members, were in various stages of development. These lessons represented an estimated 60 to 80 hours of instruction. A catalog was published which listed the programs, their authors, and other information. Some 450 student-contact hours were taught to veterinary students, using two of the programs on PLATO III.

In the two-year period, the various capabilities of PLATO were explored. Several instructional strategies were employed (testing, inquiry, tutorial, problem solving, simulation and gaming). The various interaction capabilities of the system were employed (pictures on the screen, audio-recordings, and touch panel). The problems of developing and presenting lessons using the PLATO system were exposed and methods for solving those problems devised.

By September 11, 1972, three PLATO IV terminals were located in the Basic Science Building of the College of Veterinary Medicine.

Rationale:

Much of the subject matter in the veterinary curriculum is particularly suited for computer-based instruction using the PLATO system. Unlike philosophical or cultural studies, many veterinary subjects are more specific and less disposed to individual opinion.

Although there has been a knowledge explosion as a result of extensive research which has been greatly beneficial, much of the information the professional student is expected to learn prior to graduation remains essentially the same after many years, e.g. the names of anatomical parts, the names and characteristics of bacteria that cause disease, the recognition of lung sounds, the diagnostic process, etc.

Much of veterinary instruction requires visual representation. This is particularly true of histology, embryology, pathology, bacteriology, parasitology, clinical pathology, clinical medicine, radiology, and surgery. The color visual display capability of PLATO IV makes it ideally suited for providing this facet of instruction.

One of the more difficult areas of instruction in veterinary medicine is that of teaching body sounds. The audio capability of PLATO IV should greatly enhance teaching heart, respiratory, and other body sounds.

Many areas of veterinary instruction require individual attention. By individual interaction provided by the PLATO system, it can be assured that the student has learned a particular facet of knowledge with acceptable standards of performance.

Teacher efficiency should be increased. Pilot programs have indicated that for some lessons, the teacher can teach more material to the same

number of students in less time.

These and other general reasons previously given show that the use of PLATO at the CVM should be a desirable means of instruction.

Organizational and Functional Chart of PLATO Project, CVM

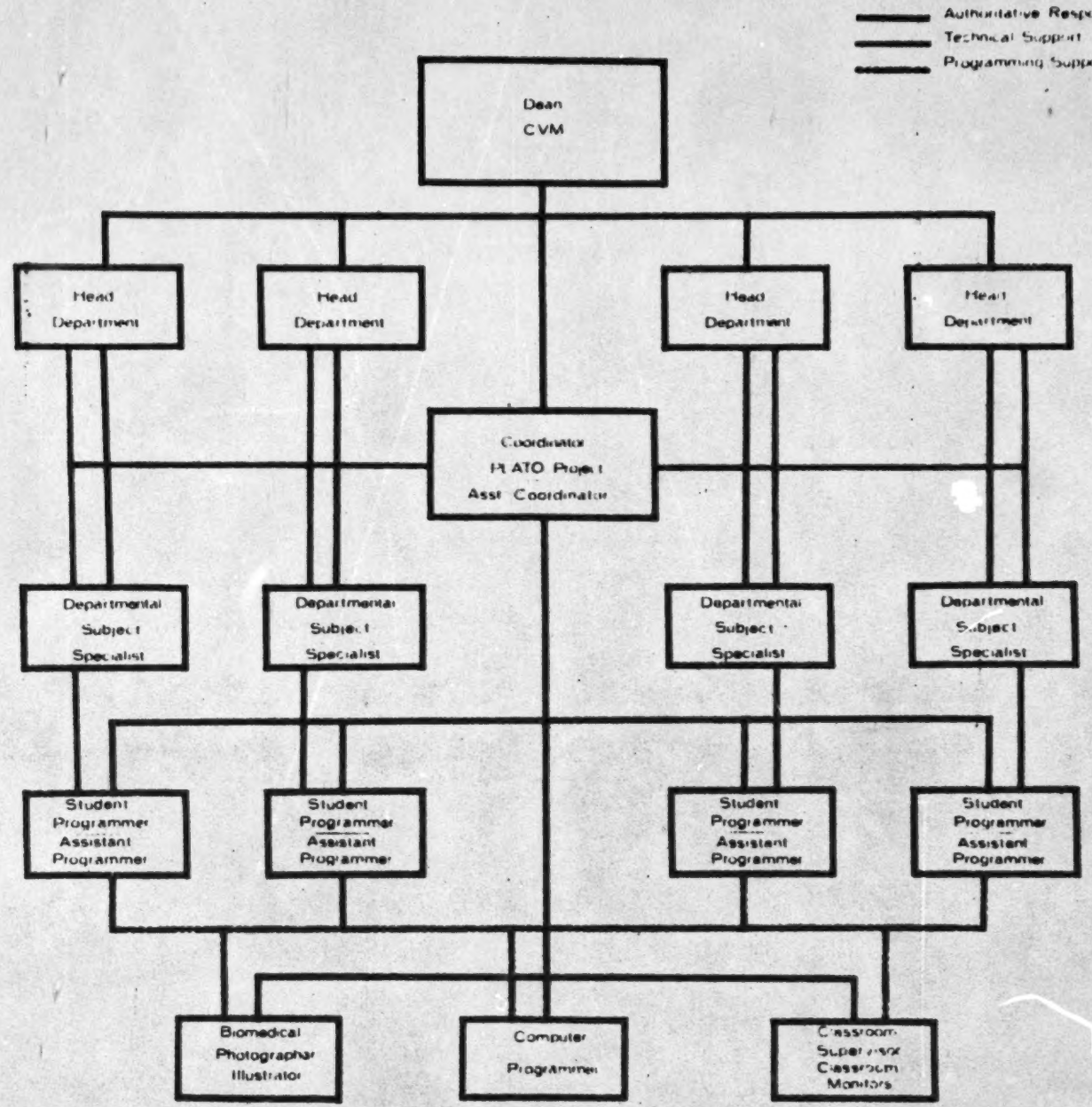


Figure 4

Organization and Functions:

The organization of the PLATO program for the CVM is diagrammed in figure 4. The Dean of CVM is responsible for the overall project. The Department Heads and Subject-matter Specialists are responsible for the subject matter content of the lessons. The Coordinator, and the Assistant Coordinator work with the Department Heads and Subject-matter Specialists in getting the material programmed on PLATO. Student Programmers program the subject matter, the Biomedical Photographer, Illustrator, Computer Programmer, and Classroom Supervisor support the total project with their various specialties.

The functions of individuals working with the CVM PLATO Project may be divided into two groups of activities, subject-matter activities and PLATO programming activities.

a. Subject-matter activities:

Department Head

(1) Selects or concurs in work of Subject-matter Specialist

(2) Concurs on subject matter to be programmed

(3) Concurs on content of subject matter

(4) Provides released time for Subject-matter Specialist

Subject-matter Specialist:

(1) Provides subject matter content

(2) Works with Coordinator and Asst. Coordinator in lesson design for PLATO

(3) Works with Student Programmer in design and programming of lessons

(4) Works with programmer in revision of lesson after student trials

(5) Works with biomedical photographer-illustrator in development of audio visuals

(6) Provides for proofing of lesson from grammatical viewpoint (spelling, etc.)

(7) Assigns students from target population for student trials

Student Programmer:

(1) Studies subject matter to be programmed

(2) Works with Subject-matter Specialist in preparing lesson for programming

(3) Programs lesson content according to desires of Subject-matter Specialist

(4) "Packages" lesson into useable form for student teaching

Assistant Student Programmer:

(1) Types rote subject matter into computer

(2) Makes minor subject matter revisions with Subject-matter Specialist

b. PLATO Programming Activities:

PLATO Project Coordinator and Assistant Coordinator:

(1) Coordinates between CERL and CVM

(2) Coordinates within CVM

(3) Designs and manages CVM PLATO Project

(4) Prepares CVM PLATO grant proposals

(5) Prepares CVM PLATO budgets

(6) Requests PLATO lesson space from CERL

(7) Assigns lesson space within CVM

(8) Maintains record of CVM lesson space

(9) Prepares catalog of CVM lessons

(10) Assists Department Head and Subject-matter Specialist in selecting subject matter for programming

(11) Assists Subject-matter Specialist in design of subject matter for programming

(12) Assigns student programmers

(13) Supervises student programmers and other CVM PLATO personnel

(14) Coordinates preparation of audio visuals for PLATO microfiche and audio unit

(15) Plans for student use of PLATO for teaching (Administrative Planning)

(16) Plans evaluation for CVM PLATO

(17) Coordinates use of PLATO with external agencies for veterinary subject matter (e.g. cont. ed., med. sch.)

Student Programmer:

(1) Develops computer flowchart for lesson

(2) Programs lesson into computer

(3) Obtains students from target population for trials

(4) Revises and perfects lesson with Subject-matter Specialist

(5) Provides instruction and lesson writing material for Assistant Student Programmer

Assistant Student Programmer:

(1) Learns to use PLATO system under Student Programmer

(2) Types rote material assigned by Student Programmer

(3) Studies existing programs

(4) Revises existing programs as assigned

(5) Prepares for independent work as Student Programmer

Biomedical Photographer-Illustrator:

(1) Prepares audio visuals for PLATO microfiche and recording disks

(2) Works with Subject-matter Specialist for development of desired audio visuals

(3) Works with Student Programmer in implementing audio visuals into programs

(4) Works with CERL staff in preparation of microfiche

Computer Programmer:

(1) Reviews CVM PLATO programs for efficient programming techniques

(2) Assists Student Programmers in developing efficient techniques

(3) Develops sophisticated programming segments for lessons

(4) Provides liasion with CERL systems programmers

Classroom Supervisor and Monitor:

(1) Maintains CVM PLATO Classroom

(2) Works with CVM students in trial of PLATO programs

(3) Provides feed-back to programmers

(4) Provides for security of terminals and equipment

(5) Assures classroom coverage during designated periods

Time Required to Produce a PLATO Program:

The time required to produce a PLATO program is highly variable. Some programs have required months, while others have been conceived and produced within a few hours. The time required of the Subject-matter Specialist varies with the amount of input he provides for the lesson. Some of the factors influencing the time are:

a. Scope of the lesson
b. Complexity of the lesson design
c. Experience of the lesson designer
d. Complexity of programming
e. Experience of the programmer
f. Amount of illustration or number of visuals required
g. Availability of information and materials (e.g. A great deal of research for information may be required, or recordings of certain body sounds may need to be obtained)
h. Amount of graphing required
i. Amount of testing needed before use

Once one lesson has been produced, the amount of time for lessons to follow shortens dramatically.

Developing a CVM Lesson on PLATO:

1. The instructor in veterinary medicine courses who wishes to prepare a lesson using the PLATO system for a part of his subject-matter has various personnel and services at his disposal.

a. The Coordinator or Assistant Coordinator can assist him in

preliminary preparation for the program, selection of subject-matter, lesson design, coordination of illustrations and audiovisuals, assignment of programmers, evaluation of programs and coordination of student use.

b. The Student Programmer works with the instructor in developing the lesson for programming and then programs the lesson for the instructor. The student programmer revises and perfects the lesson to meet the desires of the instructor. Where there is material to be added to a program, such as additional organisms after a basic program has been developed, an assistant programmer may be assigned to perform this function.

c. The Computer Programmer (or Senior Programmer) assists the the instructor and the student programmer in developing complex computer techniques which make the program perform in the manner the instructor desires and in an efficient manner (e.g. using a minimum of computer core space).

d. The Biomedical Photographer and Medical Illustrator assist the instructor by preparing audiovisuals for the lesson that meet his desires. They also see that the PLATO microfiche and audio disks are prepared. They work with the programmer in implementing the audio visuals in the program.

e. The Classroom Supervisor assists the instructor by processing CVM students through the program on a trial basis and providing feedback to the instructor and programmer. At the time of instruction of a class, the classroom supervisor

plans for and implements that instruction.

f. Other services that may be needed in the development of a CVM lesson are provided from PLATO funds. Expensive items will require consideration and approval.

2. Once the instructor has decided to prepare a lesson, he needs to make other concurrent decisions: (The Coordinator or Assistant Coordinator can assist him in making these decisions.)

a. He needs to determine how much time he can devote to developing a lesson. This influences the length and complexity of the lesson. It is recommended that the first lesson be short and relatively simple. The estimated minimum amount of time for working with a programmer is approximately one hour per week.

b. He needs to select the lesson to be programmed. In deciding on the lesson, the instructor should take into consideration the educational characteristics and instructional methods available on PLATO (See PART II). He should consider selecting a problem area in which the lesson material is desirable for programming. Some of the factors to be considered are:

(1) The instructor's own area of competence. An area in which the instructor is particularly qualified is more likely to produce a better lesson with wider acceptance.

(2) Length of lesson. This depends on a number of factors which the instructor must decide. Generally, greater

learning will probably take place with shorter lessons. Quality: Length ratio--"The higher the quality, the longer the program may be."

(3) Concreteness of the information. Abstract information or information that varies substantially from individual to individual is unlikely to make a desirable lesson.

(4) Ease of programming. Somewhat related to concreteness, some material lends itself better to programming than other material. The simpler and more generally accepted the lesson, the easier it is to program. This does not mean that the lesson matter is not important. Also, if another medium can present the material more efficiently than PLATO, that medium should be used.

(5) Availability of the material on other media. Lessons which have been well developed on other media which is accessible to the student are less desirable for programming.

(6) Cost of teaching. Some lessons may not be taught as completely as desired by conventional methods because of the prohibited costs of supplies or student time. By simulating such lessons, as in the case of the bacteriology program, costs can be minimized.

(7) Availability of clinical material. Some clinical cases may not occur frequently enough to give the student an encounter with those cases. Exotic diseases, destructive diseases such as anthrax, and infrequent diseases may be

desirable for programming.

(8) Ability of the lesson to "stand alone" within the subject matter area should be considered. Generally the flexibility of a lesson to be taught over a greater length of time (rather than restricted to a short time frame), the better for programming. If a lesson must be taught on a particular day in order to fit into the instructional sequence, the more difficult it is to plan for all students to study that lesson when there is a limited number of terminals.

(9) Level of competence desired in the student. If a skilled level is desired so that the student needs to be drilled until he is fully competent, then the "drill and practice" capability of PLATO is most useful.

(10) Depressed level of learning on the part of students. Some lessons seem difficult for some students to grasp under conventional methods of instruction. By programming, the student can work at his own pace, repeating if necessary, until he is able to grasp the material.

(11) Student interest in the subject-matter. Programming material which has low student interest in a novel way, or "bootlegging" it on material that has a high student interest, may increase learning and student pleasure in learning. Programming material of low student interest in the same manner that it has been taught conventionally is unlikely

to improve the palatability of the subject; however, by programming such material on PLATO, consideration can be given to making the lesson more interesting.

3. After the instructor has selected a lesson he wishes to program, he should then attempt to determine what he wants the student to be able to do as a result of going through the lesson. This need not be a formal list of instructional objectives as envisioned by Mager and others, but an attempt should be made to avoid words that connot be measured. Usually a general objective statement is sufficient, at least to start with. An example might be "to identify a virus based on serologic determinations." Again, the Coordinator, Assistant Coordinator, and Programmer may be helpful in determining the objectives of the lesson.

4. The lesson should now be designed. Lesson designing is probably best accomplished by the joining efforts of the instructor and the Coordinator or Assistant Coordinator, and the programmer. The Assistant Coordinator has graduate training in message design. The programmer keeps in mind what the instructor desires and prepares a logic diagram accordingly. This logic diagram or charting of the lesson is not intended as "eye wash," but has specific purposes. First it is an organization and communication tool. The instruction is planned in an organized manner and the other persons concerned with the lesson can see more clearly what is intended. It reduces loose ends in the program, it indicates all pathways available, it provides an overview of the program, and it makes programming easier. Primarily it prevents programming the lesson in a manner that the instructor does not intend. An individual becomes more proficient in preparing a lesson diagram from lesson to lesson.

5. The lesson is now ready for programming. A lesson space request form is filled out and a lesson space is requested on the computer. (See Annex A). The programmer then programs the lesson using the TUTOR language.

6. When the programmer feels the lesson does what is expected, the instructor should review the lesson to see if it does what he expected. Revisions are made to meet his desires.

7. Audiovisuals are prepared and/or accumulated for the lesson. A microfiche is not made until the program is working efficiently in the manner expected. The cost of making microfiche and the lack of flexibility in making changes requires that microfiche be made last.

8. After the program is working and before making a microfiche or audio disk, the program should be tried by students of the target population. After each student, the program should be corrected based on the findings of the student. This does not mean that the student dictates the changes, but that errors encountered are corrected. Such errors include: misspelled words, sentences that cannot be understood, frustration points that need "helps" inserted, etc. Usually five students are enough for getting the program ready for class use.

9. Upon completion of the program, revisions and preparation of the microfiche, the program should be used for a class of students. It is desirable to divide a class and teach one by conventional methods and the other by PLATO and determine by test whether one method is superior. (NOTE: After the instructor has gone through the process of developing a lesson, he will probably teach the lesson better using conventional methods.)

10. When a program is in use by a class, various evaluations can be made:

a. Amount of learning, pretest vs post-test

b. Amount of learning, post-test from two groups

c. Student attitudes

d. Individual student proficiency

e. Individual student efficiency in going through the lesson

This and other information can be collected in student data banks for instructor use in evaluating the student and his program.

Developing a Case for the Veterinary Diagnosis Program:

Veterinary clinicians who wish to develop a case for the Veterinary Diagnosis Program should complete a "Case Development Outline." These forms are available by contacting the office of the Coordinator. Instructions are provided with the forms; however, personal guidance will be provided by the Coordinator or a member of the staff.

Credit and Author Protection:

All individuals who have a substantive input into a lesson should receive credit for their effort. The amount of effort and expertise necessary to produce a lesson is usually about equally divided between the subject-matter Author, the Program Author, and for many programs, the Lesson Design Author, Artist or Photographer.

The title page of the program bears the title of that lesson, the agency (i.e. PLATO Project, CVM, U of I), and the following:

Subject-matter contributor:	(Name of Subject-matter Spec.)
Lesson Designer:	(if appropriate)
Programmer:	(Name of Programmer)
Artist or Photographer:	(if appropriate)

Individuals who prepare cases for the Veterinary Diagnosis Program have a summary page which reads:

This case was prepared by:

(Name of Clinical Veterinarian)
(Position or Title)

He has the following comments concerning the case:

"(Summary and pertinent information about the case which the clinician wishes to enter)"

An effort is being made to provide some protection for authors similar to, if not the same,as copyright protection for publications. The embryonic state of computer-based education is such that protective measures are not satisfactorily worked out.

At present the following security measures are used:

1. Each lesson is protected by a security code. Only authorized individuals can enter the author mode of the lesson and review its contents.
2. A statement is under consideration which it is hoped will give implied protection to CVM programs. This statement should soon appear at the beginning of all CVM programs.

At present, it seems evident that the best protection is that the subject-matter content, the programming, and/or the audiovisuals, be of such quantity or complexity that plagiarism is thwarted by the sheer effort necessary to appropriate such materials.

ANNEX A

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
College of Veterinary Medicine

DATE:

TO: PLATO Lesson Assignment, CERL

FROM: Coordinator, PLATO Project, CVM

SUBJECT: Request for PLATO Lesson Space

Request that lesson space be assigned to the College of Veterinary Medicine for the following proposed or existing lesson:

File Name: Student Level:

Lesson Title: Course No.:

Subject Matter Contributor: Tel:

Lesson Designer: Tel:

Programmer: Tel:

Objectives of the lesson:

Proposed Plan of Instruction:

Other Comments:

Distribution:
Orig.: PLATO Lesson Assigner, CERL
Copy : Lesson file
Copy : Programming Author

Contact Tel. No.:
333-7407 or 333-7467